इंटरनेट मानक

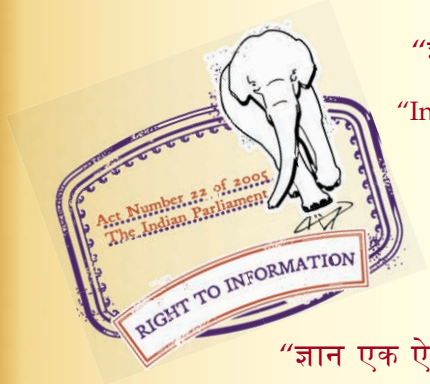
Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 10000-5 (1980): Methods of tests for intrnal combustion engines, Part 5: Preparation for tests and measurements for wear [TED 2: Automotive Primemovers]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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UDC 621·43·018 : 620·178·16

Internal Combustion Engines Sectional Committee, EDC 14; Methods of Test and Codes of Practice for Engines Subcommittee, EDC 14 : 3 [Ref : Doc : EDC 14 (3128)]

Indian Standard

METHODS OF TESTS FOR INTERNAL COMBUSTION ENGINES

PART V PREPARATION FOR TESTS AND MEASUREMENTS FOR WEAR

1. Scope — Lays down the guidelines for preparation of the engine for conducting the type tests and performance tests. It also specifies the mode for measurement of wear of critical components of engines for quality assurance purposes.

2. General Requirements for Tests — The manufacturer shall supply the performance characteristics of the engine prior to the commencement of the tests and all other information as required according to IS : 10000 (Part XI)-1980 ' Methods of tests for internal combustion engines: Part XI Information required with enquiry or order and information supplied by the manufacturer with the engine '.

2.1 The engine offered by the manufacturer for the tests shall be from regular production line, and run-in for the period recommended by him. All parts essential for engine operation shall be included. Accessories used on the engine under test shall be listed [*see* IS : 10000 (Part I)-1980 Methods of tests for internal combustion engines: Part I Glossary of terms relating to test methods].

2.2 The manufacturer shall supply a set of printed literature giving technical specifications, operating instructions, servicing schedule and wear limits of various components listed in **3** (*see also* Appendix A).

3. Preparation for Tests — The engine shall be completely dismantled and examined physically so that design features and also the conditions of the various parts may be noted before tests are commenced. After the physical examination, the dimensions of the main working parts, listed below, shall be checked and recorded in the proformae given in Appendix A.

a) Cylinder head
b) Cylinder bore/Cylinder liner
c) Piston
d) Piston rings
e) Gudgeon pin
f) Valves (inlet and exhaust)
g) Valve seats (inserts)
h) Valve guide
j) Valve springs
k) Connecting rod
m) Big end bearing
n) Small end bush
p) Connecting rod bolts and nuts
q) Crankshaft
r) Crankshaft bearings and journals
s) Camshaft
t) Injection nozzles
u) Timing gears (backlash shall be measured before and after endurance test)

3.1 The engine shall then be re-assembled by (or under the supervision of) the manufacturer, mounted on a suitable test bed and run-in for the period and in the manner recommended by the manufacturer The running-in period shall be stated by the manufacturer. In case the engine has not been run-in by the manufacturer prior to offering for test, the engine shall be run-in for a period and in the manner recommended by the manufacturer and this shall be mutually agreed between the manufacturer and purchaser or the inspecting authority. During the running-in none of the critical components listed in **3** above and in IS : 10001-1981 ' Specification for performance requirements for constant speed compression ignition (diesel) engines for general purposes (up to 20 kW) shall be allowed to be replaced. In case any of these parts need to be changed during running-in, the engine shall be discarded and fresh engine selected for testing.

Adopted 29 December 1980 Gr 9

BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

3.2 In case of engines above 20 kW, it is recommended that stripping and assembly be done at the premises of the engine manufacturer, subject to agreement between the manufacturer and the purchaser or the inspecting authority

3.3 After completion of running-in, the servicing of the engine shall be carried out in accordance with the manufacturer's schedule.

3.4 No modifications replacements shall be allowed during the running-in and regular testing which have direct bearing on the performance of the engine If any modification alteration is considered necessary by the manufacturer, he may withdraw the engine from the test and submit another engine after incorporating the required changes. The changes carried out by the manufacturer shall be stated and he will have to complete all the necessary formalities for tests separately for the testing of the modified engine

4. Preliminary Run for Constant Speed Engines — The engine shall be subjected to a preliminary run of 49 hours at the rated speed under operating temperatures specified by the manufacturer, in non-stop cycles of seven hours each, conforming to the following cycle pattern, the period of each run being a minimum of one cycle

Load (Percent of Rated Load)	*Running Time* (hours)
25	1·5
50	2
75	1·5
100	2

4.1 Before starting the next cycle the temperature of the engine sump oil shall have reached within 5K of the room temperature

4.2 During the preliminary run, attention shall be paid to engine vibration and quietness. The oil pressure shall be checked from time to time

4.3 Oil, coolant and fuel leaks shall be rectified and related components causing leaks replaced, as may be found necessary The complete record of such attention and of the running time of components changed, shall be kept.

5. Preliminary Run for Variable Speed Engines Before offering it for the type test, the engine shall be prepared and well run-in Again, before commencement of the test the engine shall be given necessary preliminary run and general observations, if any, may be made before the commencement of the type tests The engine shall be fitted with the auxiliaries required to enable it to give an output in accordance with the net output condition described in IS 10000 (Part II)-1980 'Methods of tests for internal combustion engines: Part II Standard reference conditions'

5.1 The engine shall be run for a total period of 10 hours at the speeds indicated as percentage of maximum speed (the speeds shall be in the multiples of 100, for example, 200, 300, 400, etc, rounded to nearest 100) The running cycle shall be as follows:

Engine Speed (Percent of Maximum Speed)	*Load (Percent of Rated Load)*	*Time* (minutes)
Idling	0	Up to 30
40	30	30
50	30	30
70	40	30
85	40	30
40	50	30
45	60	30
50	60	30
60	60	30
70	60	30
80	60	30
85	60	30
95	60	30
100	80	30
60	80	30
70	80	30
100	100	30
70	100	30
85	100	30
100	100	30

AMENDMENT NO. 1 MARCH 1985

TO

IS:10000(Part 5)-1980 METHODS OF TESTS FOR INTERNAL COMBUSTION ENGINES

PART 5 PREPARATION FOR TESTS AND MEASUREMENTS FOR WEAR

[*Page 1, clause 3, item*(j)] - Substitute 'Valve springs and governor springs' *for* 'Valve springs'.

(EDC 14)

Printed at New India Printing Press Khurja India

6. Measurements for Wear

6.1 *Final Inspection* — At the completion of type tests, the engine shall be dismantled. Its condition shall be noted and the dimensions of critical parts mentioned in 3 shall be recorded in the proformae given in Appendix A.

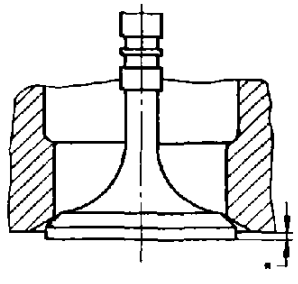
6.1.1 The wear of critical components shall be recorded in proformae given in Appendix A and shall be compared with the declarations made by the manufacturer.

APPENDIX A

(*Clauses* 3 *and* 6)

PROFORMAE FOR RECORDING DIMENSIONS OF CRITICAL COMPONENTS OF ENGINES AND MEASUREMENTS FOR WEAR AFTER ENDURANCE TESTS

A-1. Measurement for Cylinder Head

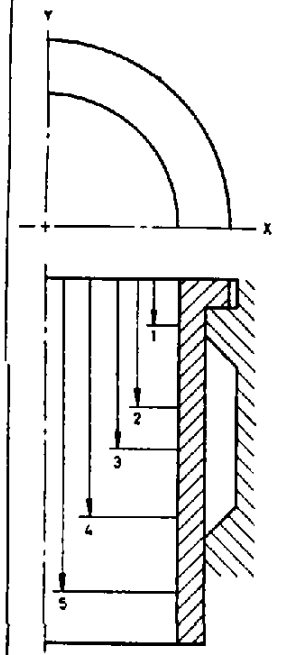


	Distance of Valve Head from Mounting Flange Face		
	Before Endurance Test	After Endurance Test	Wear
Inlet Valve Side			
Exhaust Valve Side			

Cylinder Head Surface Condition (Specify) (Add or Cross Out)	Pitting, Erosion, Scratches, Warping, ...

Note — The measurements shall be made for each cylinder.

A-2. Measurements of Cylinder Bore/Cylinder Liner

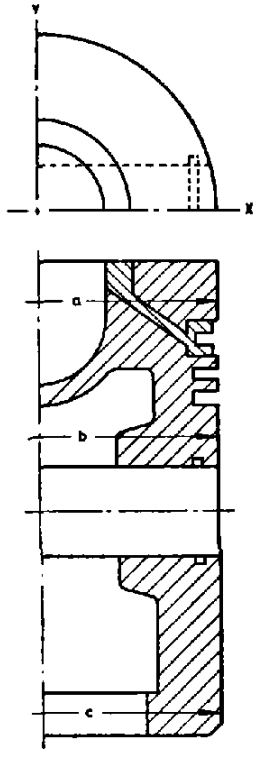


	Dimensions at Positions Indicated in Fig.														
	Before Endurance Test					After Endurance Test					Wear				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Along Crank-shaft Axis															
Perpen-dicular to the Crank-shaft Axis															

Surface Condition (specify) (Add or Cross Out)	Burning, Pitting, Erosion, Scratches, Warping, etc

Note — The measurements shall be made for each cylinder bore/liner.

A-3. Measurement of Piston Dimensions — (*See also* IS : 8503-1977 Technical supply conditions for pistons for I. C. Engines).

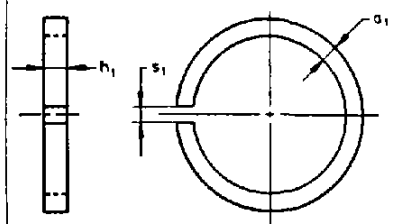


Diameter of Piston at Position		Before Endurance Test		After Endurance Test		Wear	
		ϕX	ϕY	ϕX	ϕY	ϕX	ϕY
	a						
	b						
	c						

Surface Condition (Specify)		
	Crown	
	Top Land	
	Skirt	

Note — Measurements shall be made for each piston.

A-4. Measurements for Piston Rings — (*See* also IS : 5791-1977*)



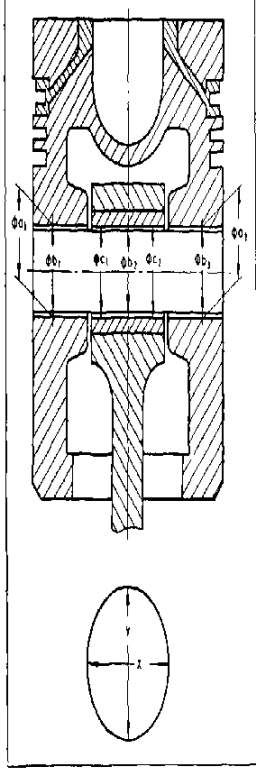
Ring No.	Dimensions of Piston Rings													
	Before Endurance Test					After Endurance Test					Wear			
	Radial Wall Thickness a_1	Ring Closed Gap, s_1 when in the Nominal Bore Specified in IS : 3511†		Axial Width h_1	Surface Condition (Specify)	Radial Wall Thickness a_1	Ring Closed Gap, s_1 when in the Nominal Bore Specified in IS : 3511†		Axial Width h_1	Surface Condition (Specify)	Radial Wall Thickness a_1	Ring Closed Gap, s_1 when in the Nominal Bore Specified in IS : 3511†		Axial Width h_1
		Compression	Oil control				Compression	Oil control				Compression	Oil control	
1														
2														
3														
4														
5														

Note — These measurements shall be taken for each cylinder.

*Cylinder bore diameters for internal combustion engines.

†Technical supply conditions for piston rings for IC engines (*first revision*).

A-5. Measurements of Gudgeon Pin, Pin Bore and Small End Bush of Connecting Rod

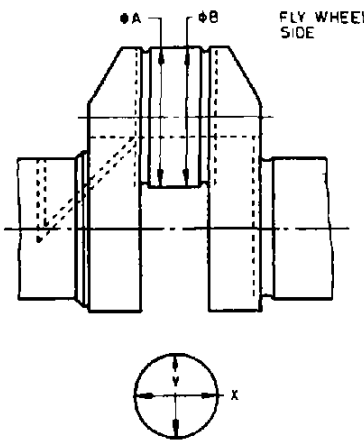


Dimensions																																			
Before Endurance Test												After Endurance Test												Wear											
Gudgeon pin bore (in piston)		Gudgeon pin diameter			Clearance between		Small end bush		Clearance between			Gudgeon pin bore (in piston)		Gudgeon pin diameter			Clearance between		Small end bush		Clearance between			Gudgeon pin bore (in piston)		Gudgeon pin diameter			Clearance between		Small end bush		Clearance between	
ϕa_1	ϕa_2	ϕb_1	ϕb_2	ϕb_3	ϕa_1 and ϕb_1	ϕa_2 and ϕb_3	ϕc_1	ϕc_2	ϕb_2 and ϕc_1	ϕb_2 and ϕc_2		ϕa_1	ϕa_2	ϕb_1	ϕb_2	ϕb_3	ϕa_1 and ϕb_1	ϕa_2 and ϕb_3	ϕc_1	ϕc_2	ϕb_2 and ϕc_1	ϕb_2 and ϕc_2		ϕa_1	ϕa_2	ϕb_1	ϕb_2	ϕb_3	ϕa_1 and ϕb_1	ϕa_2 and ϕb_3	ϕc_1	ϕc_2	ϕb_2 and ϕc_1	ϕb_2 and ϕc_2
X																																			
Y																																			

		Before Endurance Test	After Endurance Test
Surface Condition	Gudgeon Pin	Specify	Burnt, Pitted, Scored, Corroded, Lacquered, Other (Specify)
	Small End Bush	Specify	Burnt, Pitted, Scored, Corroded, Lacquered, Other (Specify)

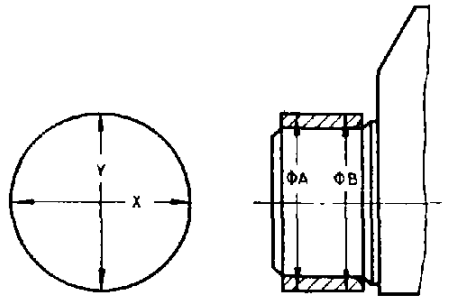
Note – These measurements shall be taken for each cylinder.

A-6. Measurements for Big End Bearing (Crank Pin Diameter)



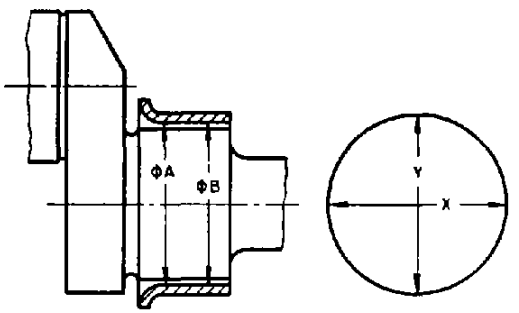
Dimensions																		
		Before Endurance Test						After Endurance Test						Wear					
Cylinder Number		1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Diameter 'A'	X																		
	Y																		
Diameter 'B'	X																		
	Y																		

A-7. Measurements for End Float



		Dimensions					
		Before Endurance Test		After Endurance Test		Wear	
		Pulley side	Gear side	Pulley side	Gear side	Pulley side	Gear side
Diameter *A*	*X*						
	Y						
Diameter	*X*						
	Y						

A-8. Measurements for Crankshaft Bearings

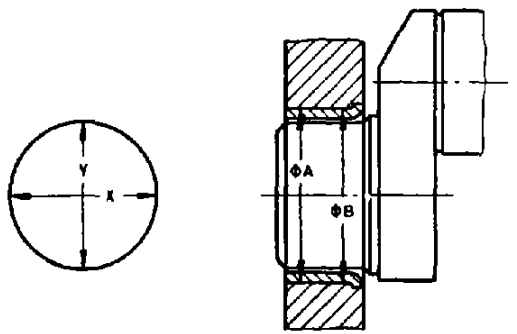


X — along thrust axis
Y — across thrust axis

		Dimensions																	
		Before Endurance Test						After Endurance Test						Wear					
Cylinder number		1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Diameter *A*	*X*																		
	Y																		
Diameter *B*	*X*																		
	Y																		

Note — For split half bearings, measurements shall be made at 60°.

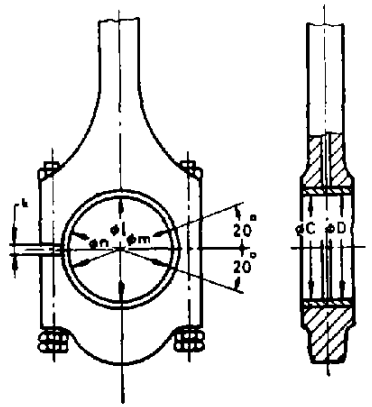
A-9. Measurements for Crankshaft Housing



X — along thrust axis
Y — across thrust axis

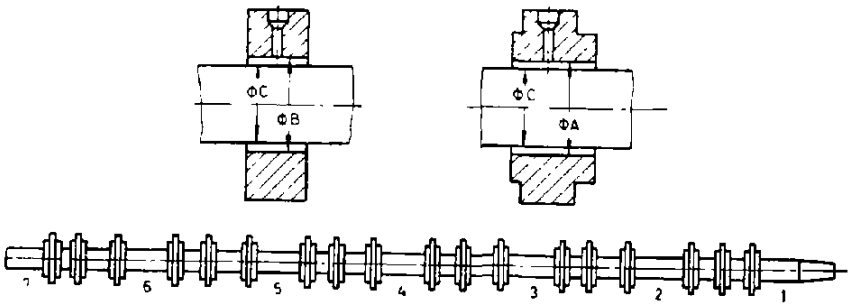
		Dimensions																	
		Before Endurance Test						After Endurance Test						Wear					
Cylinder number		1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Diameter *A*	*X*																		
	Y																		
Diameter *B*	*X*																		
	Y																		

A-10. Measurement of Connecting Rod Bearing Bore



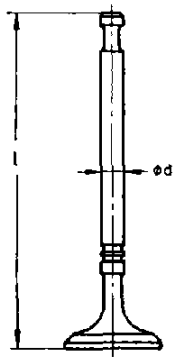
		Dimensions																	
		Before Endurance Test						After Endurance Test						Wear					
Cylinder number		1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
φC	φl																		
	φm																		
	φn																		
φD	φl																		
	φm																		
	φn																		
Gap k																			

A-11. Measurements of Camshaft Bearings



		Dimensions of Bearing No.																			
		Before Endurance Test							After Endurance Test							Wear						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Bore	ϕA																					
	ϕB																					
Diameter of crankshaft	ϕC																					
Clearance between	ϕA and ϕC																					
	ϕB and ϕC																					

A-12. Measurements for Inlet and Exhaust Valves — [*see also* IS : 810-1974 Specification for inlet and exhaust valves for I. C. engines (*first revision*)].

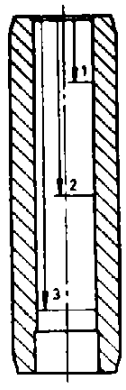


		Dimensions		
		Before Endurance Test	After Endurance Test	Wear
Stem Diameter *d*	Inlet valve			
	Exhaust valve			
Length *l*	Inlet valve			
	Exhaust valve			

		Valve Stem	Valve Face
Surface Condition (Specify)	Inlet		
	Exhaust		

Note — The measurements shall be taken for each cylinder.

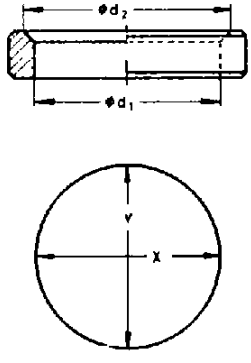
A-13. Measurements for Valve Guides



	Diameter at Positions Indicated in Fig.								
	Before Endurance Test			After Endurance Test			Wear		
	1	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*
Along the Crankshaft Axis									
Perpendicular to the Crankshaft Axis									

Note — These measurements shall be taken for each valve.

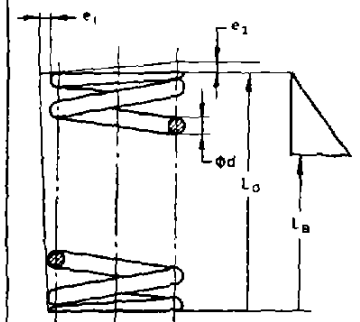
A-14. Measurements for Valve Seat Inserts



		Dimensions		
		Before Endurance Test	After Endurance Test	Wear
ϕd_1	*X*			
	Y			
ϕd_2	*X*			
	Y			

Note — These measurements shall be taken for each valve.

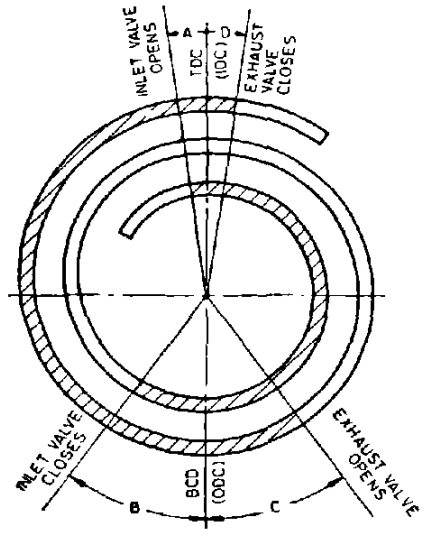
A-15. Measurements for Valve Springs and Governor Springs (Wherever Applicable) — [*see also* IS : 7906 (Part 1)-1976 Helical compression springs: Part I Design and calculations for springs made from circular section wire].



		Before Endurance Test						After Endurance Test						Wear					
		Unloaded Length L_0	Block Length L_B	Spring Rate S_c	Wire Diameter d	e_1	e_2	Unloaded Length L_0	Block Length L_B	Spring Rate S_c	Wire Diameter d	e_1	e_2	Unloaded Length L_0	Block Length L_B	Spring Rate S_c	Wire Diameter d	e	e_2
Valve Spring	Inlet																		
	Exhaust																		
Governor Spring (if Applicable)																			

Note — These measurements shall be taken for each spring.

A-16. Valve Timing Diagram

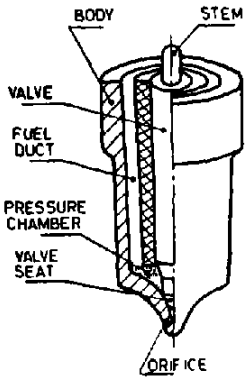


Type of Engine

Engine No.

	Before Endurance Test	After Endurance Test
Inlet Valve Opens (*A*)		
Inlet Valve Closes (*B*)		
Exhaust Valve Opens (*C*)		
Exhaust Valve Closes (*D*)		
Fuel Injection Starts (By Spill Cut-off)		

A-17. Measurement for Fuel Injection Nozzles (*See* IS : 3170-1965 *Dimensions for Injection nozzles, size 'S' for diesel engines*)



Injector No.	Parameters									
	Before Endurance Test					After Endurance Test				
	Opening pressure kPa	Valve seat tightness	Chattering test	Spray* pattern	Remarks	Opening pressure kPa	Valve seat tightness	Chattering test	Spray* pattern	Remarks
1										
2										
3										
4										
5										
6										

Note 1 — The conditions of nozzle seat, nozzle body, nozzle tightening nut, nozzle valve, spindle, nozzle spring, adjusting screw, counter nut, etc, before and after the tests to be mentioned in the remarks column.

Note 2 — These measurements shall be made for every injection nozzle.

*Spray pattern check is only visual.

EXPLANATORY NOTE

The testing and performance of constant speed and variable speed internal combustion engines was earlier covered by the following Indian Standards:

i) IS : 1600-1960 ' Code for type testing of constant speed internal combustion engines for *general purposes* ',

ii) IS : 1601-1960 ' Performance of constant speed internal combustion engines for general purposes ',

iii) IS : 1602-1960 ' Code for type testing of variable speed internal combustion engines for automotive purposes ', and

iv) IS : 1603-1960 ' Performance of variable speed internal combustion engines for automotive purposes '.

These standards were originally issued in the year 1960 and as a result of implementation of these standards by the manufacturers of engines and testing laboratories, as also the operation of ISI Certification Marking Scheme, these standards have now been extensively revised.

While IS : 1600 and IS : 1602 covered the codes for type testing of constant and variable speed engines respectively, the performance requirements of such engines were covered by IS : 1601 and IS : 1603, respectively. These standards are replaced by two sets of standards, one set covers the methods of testing of engines and the other covers the specification and performance requirements of both constant speed and variable speed engines.

The standard covering methods of tests is being published in following 12 parts (each part covering a particular test method or information related to methods of tests):

i) IS : 10000 Part I Glossary of terms relating to test methods

ii) IS : 10000 Part II Standard reference conditions

iii) IS : 10000 Part III Measurements for testing, units and limits of accuracy

iv) IS : 10000 Part IV Declarations of power, efficiency, fuel consumption and lubricating oil consumption

v) IS : 10000 Part V Preparation for tests and measurements for wear

vi) IS : 10000 Part VI Recording of test results

vii) IS : 10000 Part VII Governing tests for constant speed engines and selection of engines for use with electrical generators

viii) IS : 10000 Part VIII Performance tests

ix) IS : 10000 Part IX Endurance tests

x) IS : 10000 Part X Tests for smoke levels, limits and corrections for smoke levels for variable speed engines

xi) IS : 10000 Part XI Information required with inquiry or order and information supplied by the manufacturer with the engine

xii) IS : 10000 Part XII Test certificates

This standard will be complementary to specifications for performance requirements of different types of engines covered by following standards:

i) IS : 10001 Specification for performance requirements for constant speed compression ignition (diesel) engines for general purposes (up to 20 kW)

ii) IS : 10002 Specification for performance requirements for constant speed compression ignition (diesel) engines for general purposes (above 20 kW)

iii) IS : 10003 Specification for performance requirements for variable speed compression ignition (diesel) engines for automotive purposes

iv) IS : 10004 Specification for performance requirements for variable speed spark ignition engines for automotive purposes

Spark ignition engines for sprayers and similar applications have been covered by IS : 7347-1974 'Specification for performance requirements of small size spark ignition engines for sprayers, etc.'

Two stroke spark ignition engines for automotive applications which were earlier covered by IS : 1603 will be covered by a separate specification.

The revised methods of tests covered by IS : 10000 have been aligned with the current international practices in the field of I.C. engines. These parts are in general agreement with the following ISO standards, issued by the International Organization for Standardization:

a) ISO 3046/I-1975 Reciprocating internal combustion engines — performance: Part I Standard reference conditions and declarations of power, fuel consumption and lubricating oil consumption

b) ISO 3046/II-1977 Reciprocating internal combustion engines — performance: Part II Test methods

c) ISO 3046/III-1979 Reciprocating internal combustion engines — performance: Part III Test measurements

d) ISO 2710-1978 Reciprocating internal combustion engines — vocabulary

This Part V of IS : 10000 covers the procedure for measurement of wear of critical components for engines. Although the wear after the endurance test has not been specified, it is expected that data collected by implementation of this standard will enable the committee to lay down the specification limits for acceptance at a later date.

IS : 10000 Part I to Part XII and IS : 10001, IS : 10002, IS : 10003 and IS : 10004 collectively supersede IS : 1600, IS : 1601, IS : 1602 and IS : 1603.

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